APPLICATION FOR PATENT

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Title: Telescoping Centralizers for Expandable Tubulars

PRIORITY INFORMATION

[0001] This application claims the benefit of U.S. Provisional Application No. 60/421,491 on October 25, 2002.

FIELD OF THE INVENTION

[0002] The field of this invention relates to completion techniques for tubulars that are centralized prior to cementing and subsequently expanded, and more particularly to telescoping centralizers in this application.

BACKGROUND OF THE INVENTION

[0003] When cementing a tubular, centralizers have been used to allow the cement to work its way fully around the tubular. Without centralizers, particularly if there is a deviation in the wellbore, there was a risk that the tubular would lay up against the borehole wall on the low side undermining the benefit of the cement in trying to seal around the tubular.

[0004] Centralizers of various types have been used in the past. The most common centralizers comprise a plurality of spaced flexible strips that extend longitudinally between a pair of end rings. The centralizers are slipped over the end of the tubular on makeup or get clamped to the tubular due to a hinge connection in each of the two end rings. These centralizers are typically made of steel. The problem with these centralizers arises if there is to be any pipe expansion. Expanding tubulars has become a more widely used procedure and such centralizers have been known to cause high stress areas on the underlying tubular during expansion to the point where the tubular can split or crack. Attempts to improve on the metal centralizers described above by making them from a polymeric material have had mixed results. The problem there has been that they

are not strong enough to hold their shape to the extent that their main purpose of centralizing is defeated. Also, their geometric dimensions do not lend themselves to be run through the previous casing string and yet still have enough standoff for suitable centralization.

[0005] Centralizing devices have also been used that are bulky and that have many moving parts. These designs are expensive, require inordinate maintenance, and are simply too large to be of use in many applications. Some examples are U.S. Patent 2,874,783 and PCT Application WO 94/13928.

[0006] Another centralizing technique for cementing tubulars has been to use telescoping cylinders that can be pushed out when the tubular is in position. These cylinders had removable barriers to let flow go through them after extension. One of their uses was to centralize a tubular prior to cementing. Some illustrations of this type of centralizing system can be found in U.S. Patents 5,228,518; 5,346,016; 5,379,838; 5,224,556; and 5,165,478. None of these centralizers were used in combination with tubulars that were to be expanded. Yet, despite the use of extendable cylinders to centralize prior to cementing, in applications where the tubular was to be expanded after cementing there was either no attempt to cement in an inclined wellbore or centralizers that wrapped around the tubular and caused stress failures when expanded were used. As a result, poor cement distribution occurred that was compounded by the subsequent expansion of the tubular. What is needed and addressed by the present invention is an effective way to centralize a tubular before it is cemented and subsequently expanded even if it is disposed in a deviated bore. The method of the present invention is to centralize using telescoping cylinders and then with the cylinders extended to expand the tubular internally to compact the setting cement and provide a reliable seal of the tubular despite the angle of inclination of the associated wellbore. These and other aspects of the present invention will be more apparent to those skilled in the art from a review of the description of the preferred embodiment and the claims, which appear below.

SUMMARY OF THE INVENTION

[0007] A method of centralizing tubulars prior to cementing and subsequent expansion involves using a plurality of telescoping cylinders whose leading or trailing end is closed and which are extended by applied internal pressure in the tubular or some mechanical means. The tubular is expanded from its interior with the cylindrical telescoping members still extended. The cement is pushed all around the tubular due to the centralizers. After the cement is delivered the expansion of the tubular pushes the telescoping members into the borehole wall.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Figure 1 is a section view of a telescoping member having a closed leading end and in the run in position showing the total extension as less than the connection or upset dimension;

[0009] Figure 2 is a section view of a telescoping member of Figure 1, shown in the extended position;

[0010] Figure 3 is an end view in the borehole with the pistons expanded just prior to cementing;

[0011] Figure 4 is the view of Figure 3 after cementing and expansion of the tubular into the cement.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] Referring to Figure 1 the wall of tubular **10** is shown with an opening **12**. The opening **12** is one of a plurality of similar openings distributed around the tubular **10**. In each opening **12** is a sleeve **14** that is firmly secured in opening **12**. It has a leading end **16** that is either flush or slightly extending beyond the outer wall surface **18** of tubular **10**. Leading end **16** should not extend beyond the dimension of the connection or upset **17**.

[0013] Alternatively, the leading end **16** can be slightly recessed into opening **12**. An outer piston **20** is slidably mounted to sleeve **14** to extend a predetermined amount

before a travel stop is engaged. An inner piston **22** telescopes with respect to the outer piston **20** and has its leading end **24** closed off. The leading end **24** is advanced by internal fluid pressure or mechanical force into contact with the borehole wall **26** in a plurality of directions to centralize the tubular **10** prior to the pumping of cement **28**. Locking ratchet mechanisms, shown schematically as **30** keep the outer piston **20** and the inner piston **22** in the position they achieve after application of pressure to the inside of the tubular **10**. In that manner the pumped cement or other sealing material **28** cannot push the pistons **20** and **22** back in after they are extended. The applied pressure to extend pistons **20** and **22** can come from the actual delivery of the cement **28** or a material that precedes it, as the pressure inside tubular **10** will be greater than the annulus **32** to provide the differential pressure to extend the pistons **20** and **22**. Alternatively, they can be mechanically extended. However, it is preferred to first fully extend the pistons **20** and **22** with fluid pressure before pumping cement **28**. In that way, the tubular **10** is securely centralized before cement **28** is delivered to annulus **32**. Figure 2 shows the set position where the leading end **24** is closed off and in contact with the wellbore **26**. It should be noted that depending on the shape of the wellbore **26** and the total extension of the outer piston **20** and inner piston **22**, some of the leading ends **24** might not be in contact with the wellbore **26** while others may be pressed against it or may have penetrated into wellbore **26**. In an alternative embodiment, the piston **22** can be mounted in the reverse position than shown in the Figures, leaving an exposed edge as its leading edge. When so oriented in this manner, edge **36** can better dig into the wellbore **26**, when extended outwardly by pressure or mechanical means to improve the fixation of the tubular **10** prior to cement delivery as well as after expansion.

[0014] As shown in Figure 1, the tubular is expanded using any one of a variety of techniques. The expansion occurs before the cement **28** sets up. The expansion tool is shown schematically as **38** and can be a swage or a device employing applied pressure to the inside of the tubular **10**. Since the pistons **20** and **22** are prevented from retracting into the tubular **10** they can dig into the borehole wall **26** as the tubular **10** is expanded. This occurs more easily with the piston **22** reversed from the orientation shown in the Figures due to exposure of edge **36**. Figure 3 shows the pistons **22** extended prior to cementing and Figure 4 shows the tubular **10** expanded with the pistons **22** digging into the borehole

wall **26**. The pistons **20** and **22** fully compensate for some out of roundness of the borehole wall **26**. Upon expansion, the tubular can conform to the shape of the borehole wall **26** or in some cases reshape the borehole wall **26** to a more round configuration. . An alternative embodiment could be where the tubular **10** is standing off of the borehole on the high side and subsequent expansion moves the pipe away from the low side towards the high side. However, even in this case, cement will be radially displaced around the pipe before expansion.

[0015] Those skilled in the art will appreciate that pistons **20** and **22** can be fully retracted for insertion of the tubular **10** into the borehole **26**. The telescoping pistons **20** and **22** allow for the use of an effective system of centralization that will not hinder the ability to subsequently expand the tubular **10**. Where in the past there have been either no centralizers used, in which cast the benefit of the cementing job may have been lost or where flexible wraparound centralizers were used which either impeded expansion or caused regions of high stress leading to tubular failure or just simply failed to function when made from non-metallic materials, the method of the present invention provides an effective way to centralize and accommodate the subsequent need to expand the tubular **10** into the cement **28** before it sets up. In this manner the cement **28** surrounds the tubular **10** and is further pushed into the wellbore as it sets up to enhance the sealing around the tubular **10** and decrease that possibility of longitudinal fluid channeling.

[0016] The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made without departing from the spirit of the invention.